

The History of Herpetological Exploration in Mexico

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Abstract. The earliest recorded exploration of the herpetofauna of Mexico was that of Francisco HERNÁNDEZ, 1570–1577. No specimens are known to have been collected; his accounts, published in 1648, were strictly descriptive and pictorial, few are reliably identifiable. Two centuries later, 1788–1803, the much less publicized but botanically more important Sessé & Mociño expedition from Spain secured incidentally a small amount of herpetological material, although none of it was reported. The earliest preserved collections were made by Ferdinand Deppe in 1824–1825. Numerous scattered collections were made in subsequent decades, all shipped to foreign countries for study. Not until Alfredo Dugès started a collection at the University of Guanajuato in 1853–1910 was there much of an effort to develop domestic resources for herpetological study. Most work remained in foreign hands even then and well into the 20th century, but it was scattered and sporadic until 1892–1906, when Nelson and Goldman initiated the most thoroughly organized, protracted survey of the country ever undertaken up to that time. Gadow followed with moderately extensive collections in 1902 and 1904. Between the 1930s and 1960s there was an explosion of foreign collecting in Mexico, reaching such magnitude that federal levies and permits were exacted to stem the flow. These actions were highly successful, and as a result relatively little foreign collecting now takes place. On the contrary, domestic activity has greatly increased. The approximate state of knowledge of the herpetofauna of each state is briefly reviewed. The limits of herpetozoan diversity and distribution in Mexico are not closely approached, however, even after five centuries of study, and will continue to attract attention for decades yet to come.

Key words. History of herpetology, scientific collections, museums.

1. INTRODUCTION

Nomenclaturally, knowledge of the amphibians and reptiles of Mexico began in 1758, when the 10th edition of LINNAEUS' *Systema Naturae* appeared. It was a very tentative start, because only one of the species treated by LINNAEUS in that work was explicitly from Mexico: a horned lizard, now *Phrynosoma orbiculare* (LINNAEUS, 1758), based in part on HERNÁNDEZ (1648). Even that species was made known through earlier descriptions, not from a preserved specimen.

2. THE ROOTS OF MEXICAN HERPETOLOGY

The first phase in the evolution of knowledge of the Mexican herpetofauna included representation of species or animal parts, like skins, claws, skulls and other hard parts. Public or private exhibits of exotic animals also began early, undoubtedly long preceding the growth of faunistic knowledge, by preservation of entire bodies, either stuffed or fluid-preserved. Even when preservation became feasible, the purpose was essentially to provide a sample of one or very few examples of each species. Intraspecific variation was, after all, a rudimentary or completely elusive concept in the early days of systematics, as species were regarded as essentially invariant (the "typological" species, or MAYR's [e.g., 1982]) "essentialistic" species), and anything dif-

ferent was regarded as a different species, again unworthy of large series.

Representative collections, built to document taxonomic diversity, not variability, were the rule as the study of nature began to advance, and they were the domain of the wealthy in much of the civilized world, mostly Europe. Private collections abounded and were the source of much published information. Unfortunately their longevity was not assured, and many were lost, but some others migrated into public institutions where perpetuity was more successfully pursued.

Reference collections, based on sufficient series to document variation, did not come into existence for Mexican herpetozoans (a collective term for amphibians and reptiles) for about a hundred and fifty years after the first name was proposed for one in 1758 by LINNAEUS. It took many years before it became generally apparent that species could be understood only as populations, not as individuals. With that understanding came the realization that knowing a species requires sizeable samples instead of one or two individuals, and with that realization came more intensive collecting than ever before.

The ground work for the study of Mexican herpetology was laid well before CORTEZ arrived in what is now the state of Veracruz in 1519. At least the Aztecs in the vi-

cinity of present Mexico City maintained one or more zoos in which reptiles and other animals from different parts of Mexico were exhibited (MARTÍN DEL CAMPO 1943, 1946a, 1946b, 1979, 1984; FLORES-VILLELA 1993a), and very likely similar exhibits were maintained by other Indian nations in Yucatán, Central America and elsewhere, although definitive evidence is lacking. Certainly there was a vast accumulation of superstition, legend, and knowledge of the native fauna by that time, as recorded in the great codices that were written and passed on to following generations by the several clerics who accompanied the Spanish conquerors (MARTÍN DEL CAMPO 1936b, 1938, 1941; FLORES-VILLELA 1993a). Snakes were especially frequently represented in adornment of temples, and were a very important foundation for extrapolation of a wide variety of religious, architectural and cosmic concepts (DÍAZ-BOLIO 1965; GUTIÉRREZ-SOLANA 1987).

3. EARLY SCIENTIFIC REPORTS

3.1. Francisco HERNÁNDEZ

Within historical times, the first notable contribution in the second phase of herpetoexploration in Mexico was that of the famed Francisco HERNÁNDEZ (1517–1587), a Spanish explorer naturalist who traveled in Mexico in 1570–1577. No herpetological specimens from those travels, if indeed any were collected, are extant, but in his great 1648 book on the natural history of Mexico he recorded 71 different species of amphibians and reptiles, of which nine were amphibians and 59 reptiles; three are totally unidentifiable, and some of the recognized species are uncertain (SMITH 1970, 1985, 1999; FLORES-VILLELA 1993a).

For his time, HERNÁNDEZ' travels were amazingly extensive, as far north as Guanajuato and Hidalgo, as far south as the coast in Oaxaca and Guerrero, eastward to Veracruz, and westward as far as Jiquilpan, near Lake Chapala, Jalisco-Michoacán. A modern interpretation of his works is in Comisión Editora de las Obras de Francisco HERNÁNDEZ (1985). His routes (Fig. 1) are depicted in a large scale map in SOMOLINOS-D'ARDOIS (1960). Not only must travel have been very rigorous at that time, but he left for Mexico when he was 53 years old – not a resilient youth. Writing assiduously as he traveled, he accumulated so much material so rapidly that he settled down in Mexico City in 1576 to finish his work and to earn his livelihood in the practice of medicine, since King PHILIP was unable to continue regular support. By September 1577 he had finished 16 folio volumes, written first in Latin, then translated into Spanish, and ultimately into the native Nahuatl. Immediately thereafter he left for Spain with the manuscript, compiling on board ship a publication budget including

notes for color illustrations. Arriving in Madrid, the manuscript was received gratefully and placed in the royal library where it remained without funds for publication. HERNÁNDEZ died 28 January 1587 without seeing his great work published. It was 1648 before the work was finally published, but in a severely abridged form. The original was destroyed in a fire in 1671.

Although of great interest historically, HERNÁNDEZ' (1648) work has had little effect upon modern herpetology, except perhaps for its indications of the origins of local folklore, much of which still persists. A conversion of Nahuatl names to possible current scientific names appeared in DUGÈS (1889) and SMITH (1970, 1985, 1999). Only one species name, *Phrynosoma orbiculare*, has been based at least in part on HERNÁNDEZ (1648).

3.2. The SESSÉ and MOCIÑO Expedition

Throughout the next several decades little new material from Mexico reached the hands of zoologists. References to Mexican species continued mostly to allude to the meager materials already available, with small additions periodically, like the axolotl in 1798. There was, however, a very important, although little noted in herpetological circles, second scientific expedition to “New Spain”, authorized in 1786 by King CARLOS III of Spain. Officially known as The Royal Botanical Expedition, but commonly referred to as the SESSÉ and MOCIÑO Expedition, it was active from 1788–1803. During that time members of the expedition collected very widely – in Central America, the West Indies, and as far north as Nootka Island in Vancouver, Canada, but most intensively in Mexico, including both coasts and Baja California (BELTRÁN 1968). Much botanical material was collected, and some zoological specimens, but none of the latter have survived to the present. What remains are huge numbers of paintings of mostly plants, but including some 200 of animals. Seven of the animal paintings depict amphibians and reptiles, and six of those are of Mexican species (MCCOY & FLORES-VILLELA 1985, 1988). The zoologist of the expedition was José Longinos MARTÍNEZ, who is credited with establishing museum collections in Guatemala City and Mexico City, although the material in the latter museum did not survive (BELTRÁN 1968).

4. THE POST-LINNEAN ERA TO 1900

LINNAEUS' *Systema Naturae* editions of 1758 and 1766, updated by GMELIN in 1789, engendered tremendous interest worldwide in discovery of new species (ADLER 1979). Collectors roamed far and wide, for their own benefit or that of their benefactors, in their eager searches for bizarre novelties. Thus the independence of Mexico, achieved in 1821, opened the door as



Fig. 1: The travels in Mexico of Francisco HERNÁNDEZ, 1570–1577. Redrawn from SOMOLINOS-D'ARDOIS (1960).

never before for collectors of any nationality to travel there, and send home whatever they could find.

4.1. Ferdinand DEPPE

The first significant collections from Mexico thereafter that found their way into permanent museums and thus persisted to the present time were obtained by two German collectors – Ferdinand DEPPE and Christian Julius Wilhelm SCHIEDE. DEPPE (1794–1861) was an intelligent and energetic young man employed in the Royal Gardens, but with a long, intimate connection to the Zoological Museum of Berlin University. He was thus recommended as the naturalist to accompany a wealthy nobleman, Count VON SACK, to Mexico to collect various organisms. He spent three years preparing himself for the job, learning English and Spanish and developing skills preparing mammals, birds, amphibians and reptiles. His emphasis was to be on birds above all other animals, although he preserved considerable numbers of reptiles, ultimately forming the basis for WIEGMANN's *Herpetologia Mexicana* (1834). The party left Berlin in August, 1824, and arrived in Alvarado, Veracruz, in mid-December, after delays and change of ships in London and Jamaica.

According to STRESEMANN (1954), DEPPE's itinerary was as follows. From 25 December 1824 to January 1825, he traveled from Alvarado to the swamps and lagunas near Tlacotalpan, Veracruz, and later in January 1825 he visited Xalapa, followed by a trip to Mexico City in February. In April he went from Mexico City to Temascaltepec, Estado de México, where he returned occasionally to the home of the son of William BULLOCK, a mining magnate. The son was a frequent companion on DEPPE's field trips. DEPPE returned to Mexico City on 10 May, remaining in that vicinity the rest of the month, during which he parted company with Count VON SACK.

In June and July 1825 DEPPE visited El Chico, Hidalgo, and Toluca, Estado de México. In the latter area he climbed the nearby Volcán Nevado de Toluca and visited Tlalpaxahua and Cimapan. On 26 August he started a long trip to Tehuantepec, taking the route through Puebla and Tehuacán, and reaching Ciudad Oaxaca on 6 September. Much time was spent in that vicinity, climbing the mountain range near the city and collecting at "Uchilacqua", and Villa Alta. He continued on his route on 22 October, reaching Tehuantepec on 28 October via San Bartolo. Early in November he proceeded to the Pacific at San Mateo and Santa María del Mar (= San

Mateo de Mar?). By 22 November he was back in Ciudad Oaxaca.

DEPPE left Oaxaca on 6 December 1825 to take a very difficult route through Valle Real direct to Alvarado, Veracruz (a route that has been exceptionally productive with respect to herpetozoans in recent decades), arriving on 22 December. He likewise had found Valle Real fruitful, and spent several weeks there beginning in early January, returning to Alvarado in March. From there he went to Ciudad Veracruz, and after a short stay left for Mexico City at the end of March. He collected mostly in that vicinity until July 16, with trips to El Chico and "Ixmiquitepec" (Ixmiquilpan?).

On 17 July 1826 DEPPE left for Rincón de Temascaltepec, from which he radiated out in various directions, to Tenancingo, Sacualpán, Real de Arriba, Jautepec and Cuernavaca. At the end of September he returned to Mexico City and prepared to return to Berlin, where he arrived on April 9, 1827.

DEPPE's collections during 1825 and 1826 were impressive: thousands of insects, quantities of reptiles, amphibians, fishes and snails, and 958 bird skins of 315 species. Hinrich LICHTENSTEIN of the Zoological Museum of Berlin bought everything, and DEPPE hoped to be rewarded with a position there or at some other institution. It was not to be, so he planned to return to Mexico with a friend, Wilhelm SCHIEDE (1798–1836), a botanist, to make their living selling zoological and botanical material to European museums and dealers.

They established headquarters in Xalapa, Veracruz, in July 1828, radiating out from there to collect in various parts of the state of Veracruz, including Mt. Orizaba, which they climbed nearly to the peak. Other visits were made to "Misantla" (Mizantla), Papantla, Ciudad Veracruz, and Laguna Huetulacán west of Cofre de Perote. Part of the material they had acquired up until 7 May 1829 was purchased by the museums of Berlin and Vienna, but the proceeds were far below expectation. They abandoned the business in 1830, SCHIEDE practicing medicine until his death in Mexico City, and DEPPE serving as an agent for merchants in various parts of the country, traveling rather widely in western and northern parts of Mexico. He soon tired of the commercial life and returned to Berlin in 1838, where he was still unable to obtain institutional appointment. He died in tragic oblivion.

Nevertheless, the contributions to Mexican herpetological exploration by DEPPE and SCHIEDE were the first of significant scientific magnitude. They were a result of the attainment of independence of the country, as well as of the concurrent burgeoning scientific growth in Europe and the pioneering zeal of two stalwart intellectuals. Their place in history was assured by the fact that

what they collected went to public institutions where it was soon studied and reported. Without such attention the historical place of even outstanding collections is greatly diminished.

4.2. Frederick Michael LIEBMANN

For example, the splendid herpetological collections of Frederick Michael LIEBMANN (1813–1856) have languished in the Zoological Museum in Copenhagen, Denmark, for over 150 years, never reported upon except for the holotypes of *Chersodromus liebmanni* Reinhardt, 1860 and *C. nigricans* Reinhardt, 1860. What treasures might lie therein remain unknown; certainly at the time they were collected they would have been of epochal importance had they been studied and reported. Unfortunately, the only locality data now available for the specimens is "Mexico".

LIEBMANN was a scientist of considerable botanical eminence, with numerous publications to his name. Yet he collected many animals as well as plants in his travels in Mexico, and his letters revealed that he was familiar with a wide variety of snakes, lizards, salamanders and anurans, some of which he no doubt included in his collections. In the event that his collections are ultimately studied, LIEBMANN's travels in Mexico would be of great importance. They were recorded as follows (paraphrased) in SMITH & BRAESTRUP (1963).

LIEBMANN arrived in Veracruz in February, 1841, with his assistant, C. Ludvig RATHSACK. On February 26 they left for Xicaltepec, 60 leagues away, in company with Baron KARWINSKY, taking the northern route via Antigua, Paso de Doña Juana, Laguna Verde, Morro, Santa Barbara and Colipa. They left KARWINSKY in Xicaltepec, and visited María de Tlepacojo (20 leagues south of Papantla), where they stayed three weeks.

Thence they went to Tezuitlán, 2050 m, remaining another three weeks, returning thereafter to Papantla, the northernmost goal of their journey. They then turned southward to Mirador, an hacienda created by C. SARTORIUS, where they established their base of operations for the next two years. Numerous forays were made from this base into adjacent territories.

Among the more important of those forays was a climb to the peak of Orizaba in September, 1841, in company with the Belgian naturalist GHIESBRECHT, another guest at Mirador. Later the same year he explored southward to Ciudad Orizaba, and thence over the edge of the plateau above Acultzingo to Tehuacán. Returning to Mirador, LIEBMANN sent RATHSACK home with the enormous collections accumulated up to that time: 50,000 specimens of dried plants, and 44 boxes of live plants, preserved reptiles, amphibians, molluscs and other miscellany.

In April, 1842, LIEBMANN again visited Tehuacán by the previous route, and continued on into Oaxaca. He ascended the 4000 m Mt. Zempoaltepec – an eminence even yet visited by very few collectors. After a considerable time at Hacienda Yavesia, near Ciudad Oaxaca, he continued southward to Pochutla (an area still very poorly known), where he remained several weeks. After making several forays into the coastal mountains and collecting marine life at “Playa de San Agustín”, and the harbor of Santa Cruz (near Puerto Angel), he followed the coast southeastward to Tehuantepec, returning via Oaxaca to Mirador, where he arrived in January, 1843. After a few weeks there he sailed home March 26 from Veracruz, with who knows how many potential herpetological prizes, now of little value.

4.3. Christian Wilhelm SARTORIUS

The headquarters LIEBMANN enjoyed at Mirador were shared by numerous other naturalists from time to time, thanks to the interest and generosity of Christian Wilhelm SARTORIUS (1796–1872), who changed his name in Mexico to Carlos. The locality thereby became famous as a collecting site for amphibians and reptiles in the mid- 1800s. According to LANGMAN (1949), SARTORIUS was born in Gunderhausen, near Darmstadt, Germany, and was educated in Darmstadt and at the University of Giessen. He was appointed in 1819 to a professorial position in Wetzlar, but fled to Mexico in about 1824 after having been arrested for reputedly subversive political activity. He settled on a small tract between Huatusco and Xalapa, where he constructed a small home, although he lived there only briefly. For a time he pursued the mining business near Zacualpan and later near Huautla and in the Estado de México. He was successful enough to return to Huatusco several years later, near where he acquired large tracts of land and established his famed Hacienda El Mirador, still in existence. Most notably he grew sugar cane, again quite successfully.

Having traveled widely in Mexico, SARTORIUS returned to Darmstadt in 1848, where he wrote extensively (e.g., SARTORIUS 1961) about Mexico, extolling its virtues and urging large-scale immigration. He returned to Mirador in 1852, remaining there the rest of his life. Although he hosted many naturalists of all interests, on his own and with his son Florentín he made extensive collections, mostly botanical but also importantly herpetological ones, that were donated to the Smithsonian Institution in Washington, D. C., to Berlin and to Kew Gardens in London. His own writings were mostly about the life, times and scenery of Mexico, which he regarded as the land of opportunity for the entrepreneur.

4.4. Francis SUMICHRAST

Auguste SALLÉ was another collector active in Mexico in the mid-1800s, although he was chiefly interested in birds. He collected some amphibians and reptiles near Córdoba, and it is known that he was at Tuxpan, Veracruz, with Adolphe BOUCARD, on April 16, 1855, where they also met Francis SUMICHRAST (1828–1882). All collected amphibians and reptiles, but Sumichrast was especially important, sending much material to the U. S. National Museum, where COPE reported on it, to Paris, where BROCCHI recorded it, and to museums in Switzerland, Germany, and England.

SUMICHRAST was born in Yvonne, Switzerland, and came to Mexico in 1855 with M. DE SAUSSURE. Political unrest made life so difficult that SAUSSURE returned to Switzerland in 1856, but SUMICHRAST remained in Mexico to devote his life to the study of natural history. He apparently lived his first few years in the state of Veracruz, but in 1868 centered his work on the Pacific slopes of the Isthmus of Tehuantepec, settling down ultimately at Santa Ifigenia, Oaxaca, where he died of cholera. He made numerous collecting trips to adjacent areas of Veracruz, Puebla, Oaxaca, Chiapas, and the Estado de México. His collections were among the most important from southern Mexico, in large part because they were promptly studied and reported by various authorities, including himself.

4.5. Darius Nash COUCH

In the northern part of Mexico, Darius Nash COUCH (1822–1897) made a very important collection of herpetozoans in 1853 in various localities in the states of Tamaulipas, Nuevo León and Coahuila, as detailed by CONANT (1968). The map accompanying the latter account is here reproduced (Fig. 2) and suffices as a summary of COUCH's itinerary. Few dates, and those mostly as months, are known, hence no attempt is made here to provide them. However, it should be noted that COUCH made the whole exploration at his own expense, and of his own volition – a major exception to the general rule. He was an army lieutenant at the time, on leave. How he developed an interest in natural history is unknown, and there are no records that he pursued it after this trip was completed. All of the material he obtained went to the U. S. National Museum.

One very notable acquisition by COUCH, at the very beginning of his trip, was the discovery of the BERLANDIER collection in Matamoros, Tamaulipas, where he purchased it from BERLANDIER's widow, subsequently sending most of it to the Smithsonian Institution along with his own collections. The collection included BERLANDIER's entire library – books, papers, manuscripts, herbarium, preserved animals and unpublished drawings.

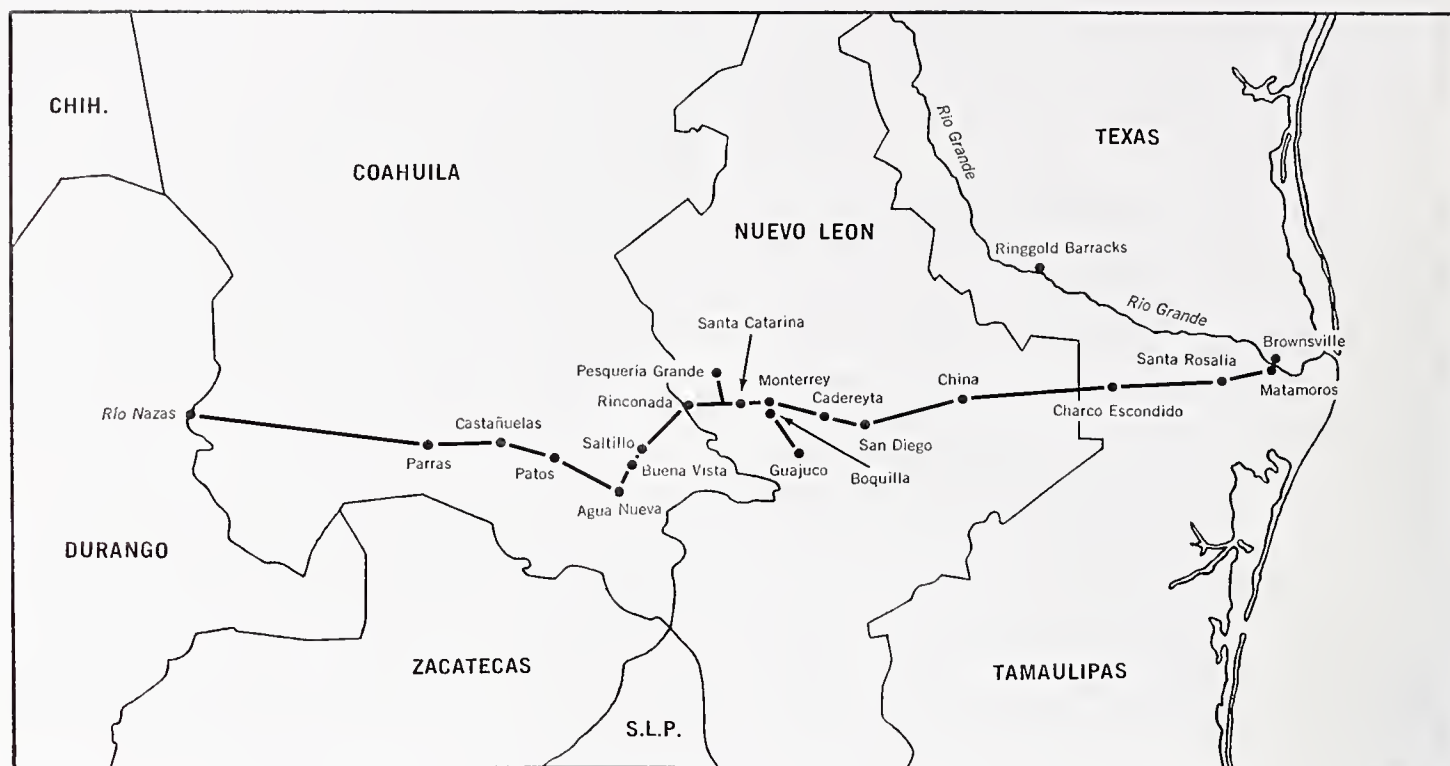


Fig. 2: The collecting sites in northern Mexico of Lieutenant Darius N. COUCH in 1853. Adapted from CONANT (1968).

4.6. Jean Louis BERLANDIER

According to GEISER (1937), Jean Louis BERLANDIER (1804?–1851) was born to an impoverished family in western France, and as an exceptionally apt student, came under the tutelage of Auguste-Pyrame DE CANDOLLE, a famed botanist. He studied in Geneva, learning Latin, Greek, botany, and scientific illustration. He was such a brilliant student that he was chosen to serve as a botanical collector on an international scientific Boundary Expedition exploring the then virtually unknown botanical wealth of what is now northern Mexico and southern Texas. He left Le Havre on 26 October 1826 and landed at Pánuco on 15 December, where he remained and collected for a short time. He then continued along the road from Huasteca to Pachuca, Tacubaya and Chapultepec. After collecting in the valleys of Toluca and Cuernavaca, he arrived in Mexico City and remained there, with occasional diversionary trips, until the Boundary Expedition departed 10 November 1827. The seven members were furnished with a small military escort, and followed the plateau route to Texas, through Querétaro, San Miguel, Guanajuato, Saltillo, Monterrey and Carrizal, reaching Laredo in 13 weeks.

BERLANDIER's work with the Boundary Commission continued, virtually all in present Texas, until September, 1829, when he abandoned the Commission in Matamoros, where he lived the rest of his life. The Commission dissolved, leaving BERLANDIER completely on his own. He married a Mexican woman, supported

his family through a pharmaceutical business, and became an eminent and much respected citizen in Matamoros, serving as a physician and maintaining a hospital there. Although he was severely criticized for having returned very little to his financiers in Geneva, a partial inventory of what he sent as a result of some three years of hard work under severe conditions, 1827–1830, was quite impressive: “188 packets of dried plants totaling some 55,077 specimens; 198 packets of plant seeds; 935 insects; 72 birds; 55 jars and bottles of material in alcohol; and more than 700 specimens of land and freshwater mollusks” (GEISER 1937).

Although his efforts on the Commission were scorned, BERLANDIER with difficulty salvaged his self-respect and continued the rest of his life collecting and studying both plants and animals as he explored widely in northern Mexico (SMITH et al. 2003). He never returned to Europe, but worked many years preparing illustrated manuscripts on the biota of northern Mexico and adjacent Texas, including at least one on reptiles and amphibians manuscripts that might well have been published were it not for his untimely death, drowning in a flood on the San Fernando River south of Matamoros. His was a sad life of frustration despite assiduous effort and superb talent.

4.7. Foreign collectors and surveys in northern Mexico

The earliest significant northern Mexican collections came from the United States and Mexican Boundary Survey commissions, 1851–1854. Three collectors were

especially important in that context: John H. CLARK, Arthur C. V. SCHOTT and Thomas H. WEBB. All of their collections went to the U. S. National Museum. According to KELLOGG (1932: 4), CLARK accompanied John Russell BARTLETT's party from Copper Mines, New Mexico, to Santa Cruz, Sonora, about 6 miles south of the United States border, from 28 August 1851 into October.

SCHOTT worked with at least three Boundary survey parties from 1851–1855, under Lieutenant A. W. WHIPPLE, Major William H. EMORY, and Lieutenant N. MICHLER. Most of his work in Mexico was along the Rio Grande (or Río Bravo del Norte).

WEBB served as a doctor and secretary for an exploration party under BARTLETT that traversed Chihuahua, Durango, Coahuila and Nuevo León in traveling from El Paso, Texas, to the vicinity of Laredo, Texas. The party left El Paso 7 October 1852, traveling southward through Guadalupe, Carrizal, Encinillas and Saucillo and arriving at Ciudad Chihuahua 22 October. WEBB's wagon broke down south of Laguna de Los Patos, and while it was being repaired the various members of the party occupied themselves collecting objects of natural history. They remained 10 days collecting in the vicinity of Ciudad Chihuahua, and left 1 November. Their route passed through northeastern Durango and Saucillo, La Cruz, Las Garzas, Santa Rosalía, Jiménez, Cerro Gordo, San Pedro del Gallo, Cuicamé and La Peñía, arriving 27 November at Parras, Coahuila. On 7 December they were in Saltillo, on 11 December in Santa Catarina, and on 12 December in Monterrey. Leaving the next day, they passed through Marín, Carrizitos and Cerralvo, arriving in Mier, Tamaulipas, on 19 December 1852. From there the party passed through Camargo on its way to Ringgold Barracks outside of Laredo, Texas.

One of the most important collections from northern Mexico received by E. D. COPE (and now in the U. S. National Museum and Academy of Natural Sciences of Philadelphia) was 500 or more specimens obtained by Edward WILKINSON, Jr., near Batopilas, Chihuahua, a mining region in the southwestern part of the state.

Aside from small collections received by the U. S. National Museum from John POTTS in 1854 and 1855, taken in Chihuahua, and others sent to the Museum of Comparative Zoology by Edward PALMER between 1878 and 1880 from Tamaulipas, San Luis Potosí and Coahuila, no further collections were made in northern Mexico until the early 1900s, and even then that area was to a considerable extent neglected as compared with other parts of the country. Although some areas have since then been explored herpetologically to a considerable extent, parts remain poorly known even today, especially in Coahuila, Chihuahua and Sonora.

The only notable early herpetological exploration in Baja California was the result of appointment of Louis John XANTUS DE VESEY, a Hungarian, in charge of a tidal station of the United States Coast Survey at Cape San Lucas, 1859–1861 (KELLOGG, 1932). He sent much material to the U. S. National Museum from there, reported by BAIRD and COPE. He was good enough at accumulating natural history material in general that he was appointed in 1863 as U. S. consul in Colima, where he continued to live up to his reputation as a collector. Questionable dealings terminated his appointment in less than a year, but he stayed on several months in Manzanillo and continued collecting.

From nearby Guadalajara a J. J. MAJOR sent material to Washington in 1861, perhaps influenced by XANTUS. Ferdinand BISCHOFF also sent material in 1868 from Mazatlán, Sinaloa. All was studied and reported in part by COPE.

4.8. Foreign collectors in southern Mexico

At the other end of the country, Arthur SCHOTT of the U.S.-Mexican Boundary Survey found favor in the eyes of Governor José SALAZAR y LARREGUI of Yucatán (who was involved in the Boundary Survey), and was appointed as naturalist on the Comisión Científica de Yucatán. Among the localities he visited were Mérida, Celestún and Sisal, Yucatán. In 1865 he sent a large collection from that area to the U. S. National Museum, and although he returned to the United States in 1866, he was again in Yucatán in 1868. He also collected in Sonora in 1871, fide KELLOGG (1932: 8).

An earlier collector, Pierre Marie Arthur MORELET, worked extensively in Yucatán as well as Guatemala in 1847–1848, for the Muséum Nationale d'Histoire Naturelle in Paris. Other European collectors at about that time included BERKENBUSCH, who obtained a sizeable collection at Matamoros and other localities in Puebla in 1870, all reported on by Wilhelm PETERS. PETERS also described material taken by Hille at Huatusco, Veracruz, the same year.

4.9. The Mission Scientifique and Biologia Centrali-Americana

Collectors for the French Mission Scientifique au Mexique (DUMÉRIL et al. 1870–1909; BROCCHI 1881–1883) worked in Mexico from 1865 to 1867, obtaining material from Adolphe BOUCARD and Auguste SALLÉ, both of whom had collected earlier in Veracruz, and under French auspices expanded their work into Oaxaca.

In the late 1870s and into the 1880s a number of collectors supported the instigators of Biologia Centrali-Americana (GÜNTHER 1885–1902) notably Frederick du Cane GODMAN and Osbert SALVIN, sending their material ultimately to the British Museum. Herbert H.

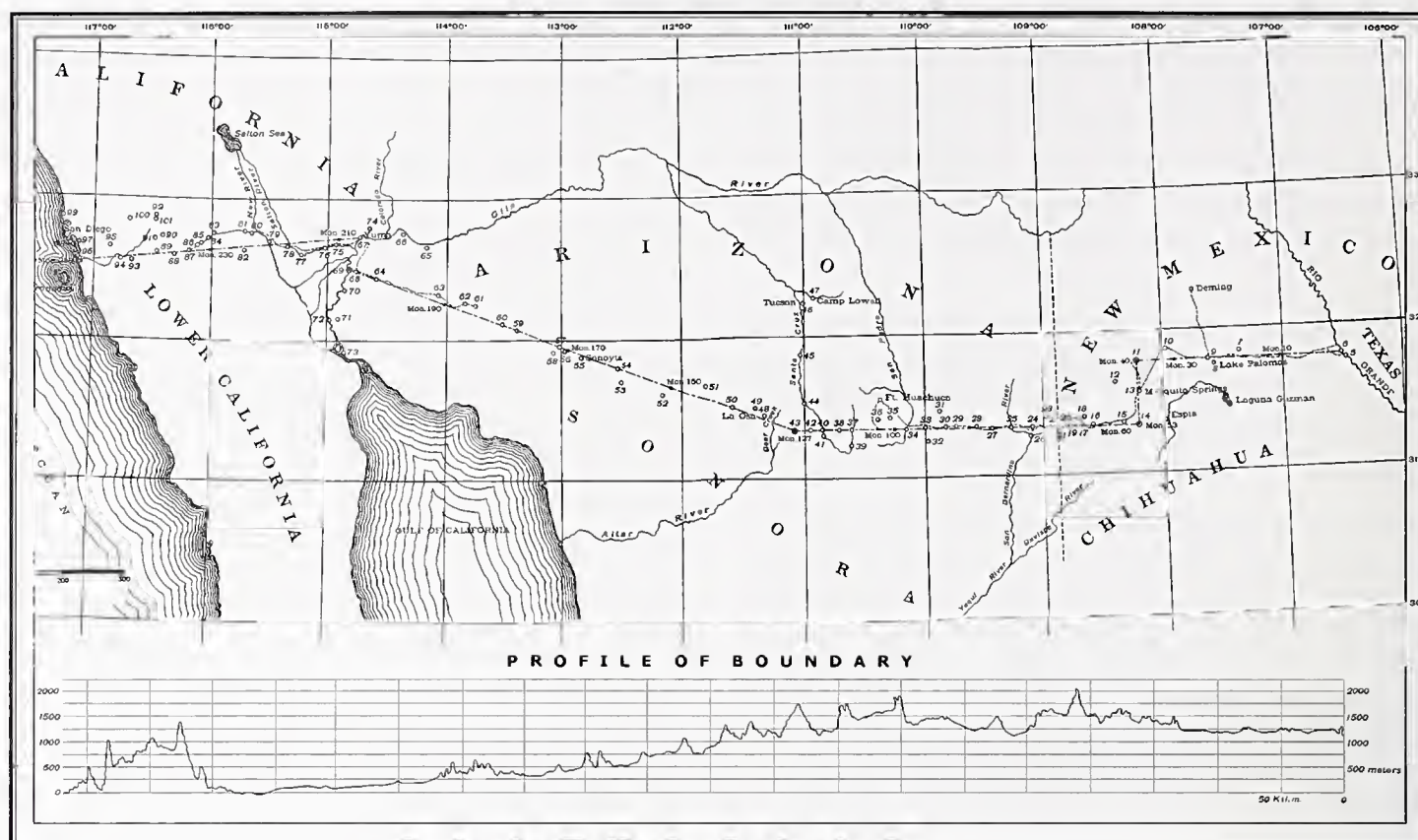


Fig. 3: The collecting sites of E. A. MEARNs along the Mexico-U.S. border, 1892–1894. Modified from MEARNs (1907).

SMITH obtained material from widely scattered localities, including Atoyac, Veracruz, Teapa, Tabasco, Omiltemi and Amula, Guerrero, and Cuernavaca, Morelos. A. C. BULLER collected in Jalisco and at Hacienda El Florencio in Zacatecas. GODMAN himself collected in Mexico in 1887 and 1888, primarily in Veracruz, including Xalapa and Mizantla, aided by C. T. HOEGE and an Indian assistant, Mateo TRUJILLO, who had collected in the Valleys of Toluca and Mexico in 1884 and 1885. Alphonso FORRER made important collections on the Tres Marias islands, at Presidio near Mazatlán, Sinaloa, and in Ventanas and Ciudad Durango, Durango. At about the same time Edward PALMER obtained material for the Museum of Comparative Zoology from Tamaulipas, San Luis Potosí and Coahuila.

4.10. Léon DIGUET

Léon DIGUET, a French chemical engineer, collected extensively in Mexico from 1888 to 1913 (ALVAREZ 1989). His chief activity focused on Baja California, where he was in charge of scientific exploration 1888–1892. He made additional forays there at various times as late as 1913. His findings on the herpetofauna of the peninsula were reported in part by MOCQUARD (1899). DIGUET also collected elsewhere in Mexico, however, including Nayarit and Jalisco (1896–1898); San Luis Potosí, Colima, and Jalisco (1899–1900); Oaxaca

(1901–1904); and Jalisco (1911–1913) (ALVAREZ 1989).

4.11. Alfredo Augusto Delsescautz DUGÈS

The most important influence upon knowledge of the herpetofauna of Mexico prior to 1900 was provided by Alfredo Augusto Delsescautz DUGÈS (1826–1910), who came to Mexico in 1853 and lived there the rest of his life. He was born in Montpellier, France, to a noted scientist and herpetologist, Antoine Louis Delsescautz DUGÈS. Alfredo studied in Montpellier and later in Paris, where he obtained an M.D. degree in 1852. He was at least the fourth generation in the medical profession in his family. In 1853 he immigrated to Mexico, staying at first in Mexico City, but very soon moving to Guanajuato, where he remained the rest of his life. He served privately as a gynecologist, but publicly as a professor of natural history and director of the museum he founded at the University of Guanajuato (MARTÍN DEL CAMPO 1937b; SMITH & SMITH 1969).

With the help of his many students, DUGÈS set out to sample as much of the biota of the state of Guanajuato, and of the surrounding territory, including Jalisco, Colima, and Distrito Federal, as he could, building a representative collection in the school's museum, and sending material far and wide to specialists elsewhere. Much went to the U. S. National Museum, but Paris and

Lyon, France, received considerable quantities, and some went to London. That material was reported in numerous publications by various foreign specialists. His own first publication on Mexican amphibians and reptiles appeared in 1865, and they continued to 1907, accumulating a total of 94 pertaining to herpetology, out of a total of 184 on various aspects of natural history. So fundamental were DUGÈS' contributions that he has been considered the "father" of Mexican herpetology (SMITH & SMITH 1969). His summary of the herpetofauna of Mexico (DUGÈS 1896) was the first to appear specifically for the country.

4.12. Collectors of the late Nineteenth Century

The Nineteenth century closed with a number of small collections in the 1890s and late 1880s, including one by William LLOYD, obtained during March and April, 1891, near the U. S. boundaries of Nuevo León and Tamaulipas. Pierre Louis JOUY obtained material in February, 1892, at Lake Chapala, Jalisco. From 1 February 1892 to 20 July 1894, Edgar Alexander MEARNs traversed the entire Mexican-U.S. boundary line, collecting a number of herpetozoans along it, although the emphasis was upon mammals; his route is depicted in Fig. 3, from MEARNs (1907). Ernest C. MERTON obtained a few amphibians and reptiles in Sonora in 1893. Edward PALMER collected in 1896 in Durango, and Charles Haskins TOWNSEND in April, 1897, in Frontera, Tabasco. H. H. and C. S. BRIMLEY acquired a nice collection in Chihuahua in 1895. Charles H. Tyler TOWNSEND collected numerous reptiles on Clarion and Socorro islands, and in the Gulf of California, in 1888–1889; additional material from the Gulf was obtained in 1911. He explored much of northwestern Mexico 1890–1895, and eastern Mexico 1895–1896 (TOWNSEND 1890, 1895, 1897, 1916). Almost all of those collections became a part of the U. S. National Museum; a few found their way to Field Museum of Natural History and the Museum of Comparative Zoology.

5. THE TWENTIETH CENTURY TO THE PRESENT

5.1. Collectors for American Museums to 1930

Desultory collections continued to be made in Mexico for the first three decades of the Twentieth Century. Seth Eugene MEEK collected in 1901 and 1903 in Tamaulipas, Guanajuato, Distrito Federal and elsewhere for the Field Museum of Natural History, and Edmund HELLER and C. M. BARBER in 1903–5 did the same in Chihuahua and Veracruz. The Field Museum also obtained material from Fernando FERRARI-PEREZ, director of the museum at Tacubaya, Mexico, in 1889.

The Museum of Comparative Zoology received material from archaeologists working in Yucatán in 1911–1912;

among them were Edward H. THOMPSON, L. J. COLE and O. RICKETSON. J. L. PETERS contributed material from Quintana Roo, and William M. MANN from Hidalgo. Emmett Reid DUNN obtained some amphibians and reptiles in Veracruz (Xalapa) and the Distrito Federal in 1921. W. W. BROWN was a professional collector who sold material to Harvard and elsewhere from widely scattered localities in Guerrero, San Luis Potosí, Sonora and Tamaulipas, as well as other states. Other collectors for the Museum of Comparative Zoology were D. B. VAN BRUNDT, G. GLÜCKERT, T. J. POTTS and G. O. ROGERS.

During July, 1925, J. R. SLEVIN collected in Veracruz, Oaxaca and Distrito Federal, the material going to the California Academy of Sciences.

In the early 1910s, A. G. RUTHVEN made sizeable collections in southern Veracruz, near the Los Tuxtlas area, for the University of Michigan and the American Museum of Natural History. A. B. BAKER also collected for the University of Michigan in Veracruz, in 1926.

Paul D. R. RUTHLING collected in Mexico for the American Museum of Natural History in 1919 and 1920, obtaining important material in Colima in April, 1919; Distrito Federal in May and July; Veracruz in June; Guanajuato in early August; Jalisco in August through October; Nayarit and Sinaloa in November and December; Oaxaca during May to early July, 1920; and Puebla during the rest of July.

Miscellaneous collections received by the U. S. National Museum in the early 1900s included material from Frederick KNAB taken near Córdoba, Veracruz, in 1908; Charles R. ORCUTT, Veracruz, 1910; J. C. THOMPSON, San Blas, Nayarit, 1913; J. A. KUSCHE, Sinaloa, 1918; Francis J. DYER, Nogales, Sonora, 1919; W. S. BLATCHLEY, Orizaba, Veracruz, 1920; William M. MANN, Tepic, Nayarit, 1923.

5.2. Hans GADOW

Up until 1900, scientific herpetological collecting in Mexico was largely sporadic, local, or incidental. The first protracted, organized and intensive collecting was conducted by two groups in the early 1900s, and they both had a great impact upon the study of Mexican herpetology. Hans GADOW (1855–1928) and his wife, traveling by railroad June–October of 1902 and 1904 (Fig. 4) in their own freight car shunted from siding to siding, amassed large collections that ultimately went to the British Museum. The species and localities where they were taken are listed in GADOW (1905), and a popular account appeared in GADOW (1908). GADOW also visited Mexico in 1908, according to the preface of the latter book, and material in the British Museum was taken by him in 1914.

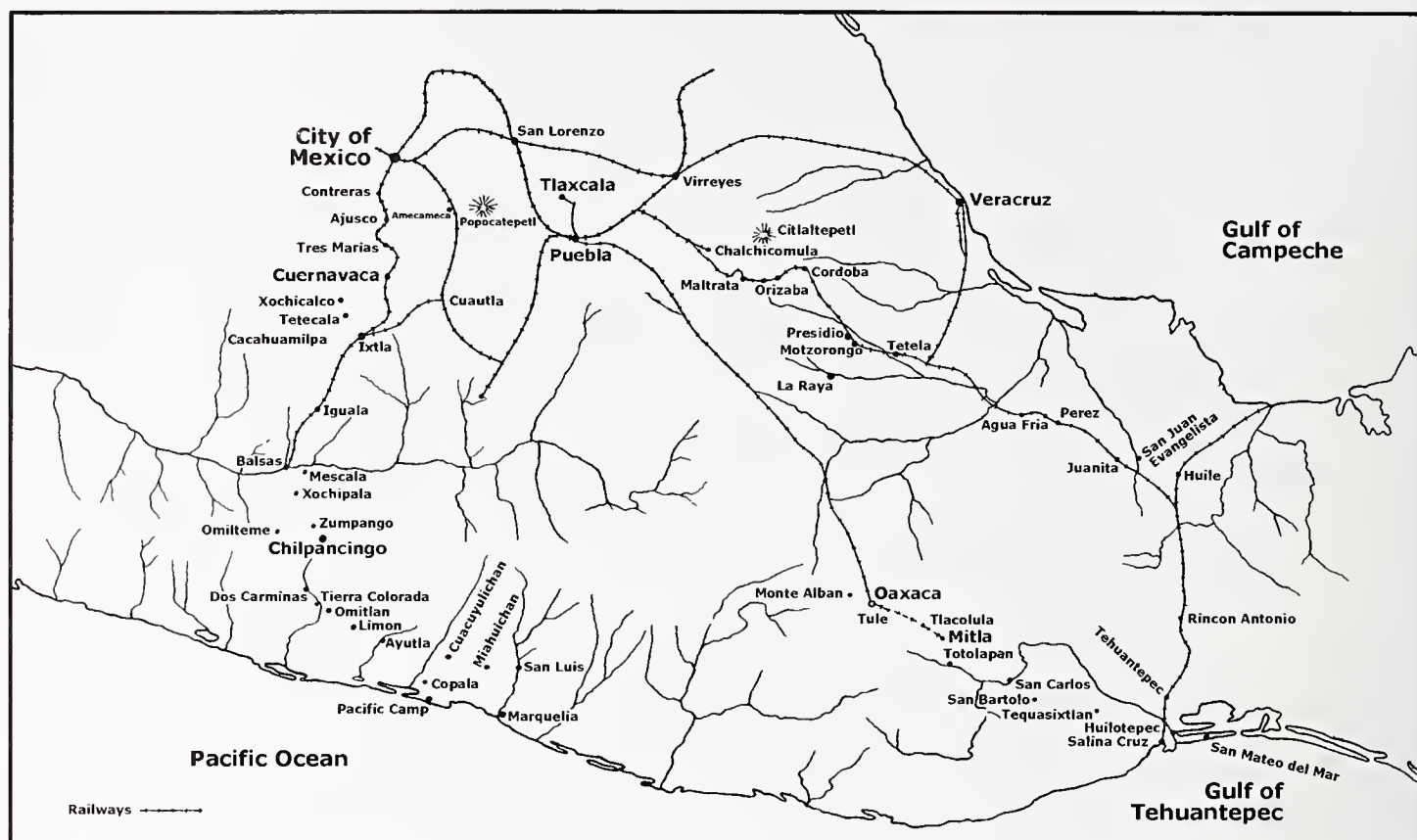


Fig. 4: The travels in Mexico of Hans GADOW and his wife, 1902 and 1904. Modified from GADOW (1908).

5.3. E. W. NELSON and Edward A. GOLDMAN

The other source, even more spectacular, was the 15-year exploration of all of Mexico by E. W. NELSON and Edward A. GOLDMAN between 1892 and 1906 (Fig. 5). They collected mostly mammals and birds, but amphibians, reptiles and plants were also taken. The amphibians and reptiles were sufficiently varied and numerous that they furnished the main basis for KELLOGG's (1932) review of the anurans of Mexico, and for many shorter accounts by various authors. The complete NELSON and GOLDMAN itinerary is given in GOLDMAN (1951). This was the first complete survey of the country for these vertebrates, and it remains one of the most important resources for herpetological study of Mexico. Every state and territory was visited at one time or another, and many several times. Also, most offshore islands were visited.

5.4. The modern era (post-1930)

The "modern" era of herpetological collecting in Mexico began in the 1930s, during which time numerous forays were made by herpetologists from the United States and elsewhere, in rapidly increasing numbers. Hundreds of professionals and amateurs sampled the fauna in numerous places, some commercially, others for scientific purposes, and many just for amateurish interests. It would be impossible to account for more than a small proportion of such activity.

5.4.1. Edward H. TAYLOR and Hobart M. SMITH.

However, to a considerable extent the sudden increase of activity was initiated by the travels of Edward H. TAYLOR and Hobart M. SMITH throughout much of mainland México in the summer of 1932, resulting in a collection of some 5,500 specimens. Together and separately they continued to collect throughout much of Mexico for a decade or more, accumulating all told some 50,000 specimens. Their summaries of the herpetofauna of Mexico (SMITH & TAYLOR 1945, 1458, 1950) served to catalyze an astonishing hyperactivity by others, in Mexico and elsewhere.

5.4.2. The rise of Mexican herpetologists.

The flood became so great, however, that in the late 1960s it was curbed by requiring a permit and imposing a levy upon collecting by foreigners. In a few years the fee became so large, and permits so difficult to obtain, that collecting by non-nationals diminished to but a dribble. At the same time, collecting by Mexican herpetologists increased enormously. Mexican institutions now contain thousands of specimens; FLORES-VILLELA & HERNÁNDEZ (1992) listed 20 institutions with 60,698 specimens of reptiles and amphibians, virtually all from Mexico. The research on the Mexican herpetofauna that for centuries was conducted almost exclusively by foreigners has been shifting increasingly over the past 40 years to Mexican institutions and scientists.



Fig. 5: The travels of NELSON and GOLDMAN in Mexico, 1892–1906. Adapted from GOLDMAN (1951).

6. THE PRESENT STATE OF HERPETOLOGICAL EXPLORATION IN MÉXICO

The exploration of the various political divisions of Mexico can be briefly summarized as follows, in approximate north-south sequence in west-east order (Fig. 6). We apologize if in the following brief review we have inadvertently neglected to note contributions that should have received attention.

6.1. Baja California and Baja California Sur

Exploration in these two states has been extensive since near the end of the 19th century. History of herpetological exploration is reviewed by GRISMER (2002). The first comprehensive account was that of VAN DENBURGH (1895a, b), based on materials, mostly in the California Academy of Sciences, obtained by various collectors, especially Joseph R. SLEVIN. It was followed by MOCQUARD's (1899) report, based on collections by Léon DIGUET. SCHMIDT (1922) was long the most recent complete account of the herpetofauna of the region, summarizing all knowledge and material then available,

and based extensively on the *Albatross* voyage (TOWNSEND 1916). MURPHY (1983) and MURPHY & OTTLEY (1984) added more insights, especially on the complex insular herpetofaunas. GRISMER (1994, 2002) reviewed the entire herpetofauna of the peninsula (Fig. 7). His book is one of the most beautiful and thorough regional herpetofaunal reviews. At present few collections are being made. Some are being developed by Francisco REYNOSO of the Universidad Autónoma de Baja California Sur. Other herpetologists in both states work mainly on ecological aspects of the herpetofauna; Patricia GALLINA at CIBNOR is a notable example.

6.2. Sonora

This state has not been systematically explored. TAYLOR (1938a) summarized herpetological exploration there previous to his time, and reported his 1934 collections in the central and western parts of the state (e.g., La Noria, localities southwest of Hermosillo, Guaymas, the surroundings of La Posada, Empalme). BOGERT & OLIVER (1945) again briefly reviewed previous work in the state, but the greatest importance of their work was the report of their epochal collections in the southeast-



Fig. 6: Map of the states of Mexico. Base map courtesy of Roger and Isabelle CONANT. AG, Aguascalientes; BN, Baja California Norte; BS, Baja California Sur; CA, Campeche; CH, Chihuahua; CL, Colima; CO, Coahuila; CP, Chiapas; DF, Distrito Federal; DG, Durango; GJ, Guanajuato; GR, Guerrero; HD, Hidalgo; JL, Jalisco; ME, México; MI, Michoacán; MO, Morelos; NA, Nayarit; NL, Nuevo León; OX, Oaxaca; PB, Puebla; QE, Querétaro; QR, Quintana Roo; SI, Sinaloa; SL, San Luis Potosí; SO, Sonora; TB, Tabasco; TM, Tamaulipas; TX, Tlaxcala; VE, Veracruz; YU, Yucatán; ZA, Zacatecas.

ern mountains in the vicinity of Guirocoba and Alamos. Otherwise little has been done. A group at the Centro Ecológico de Sonora (now Instituto del Medio Ambiente del Estado de Sonora [IMADES]) in Hermosillo, has a collection of over 1,200 specimens, largely amassed by Guillermo LARA-GÓNGORA, which forms the nucleus of the herpetological activity in the state. The areas in greatest need for exploration are in the mountains in the eastern part of the state, where access is difficult.

6.3. Chihuahua

Extensive collections from the state of Chihuahua exist at the University of Arizona, University of New Mexico, University of Texas at El Paso, and at Brigham Young University. No thorough review of the herpetofauna of the state as a whole exists, but TANNER (1985, 1987, 1989) provided an excellent review of the western

herpetozoans, based largely on collections at Brigham Young University amassed between 1931 and 1972, mostly in the vicinity of the Mormon colonies in that part of the state. TANNER (1985) briefly reviewed previous herpetological surveys in the state, but omitted mention of the especially important WILKINSON collections of over 500 specimens taken in the late 1870s and early 1880s from the previously unsampled, distinctive fauna near Batopilas, Chihuahua (COPE 1879, 1886). At present Julio A. LEMOS ESPINAL, from UNAM, is vigorously sampling the herpetofauna of Chihuahua, filling in many gaps remaining from previous studies, which have been largely confined to main roads, at least in the east (LEMON-ESPINAL et al. 2003). A group of herpetologists led by Ana GATICA is active in the Universidad Autónoma de Ciudad Juárez. The southern mountains remain poorly sampled, and so also the eastern border areas.

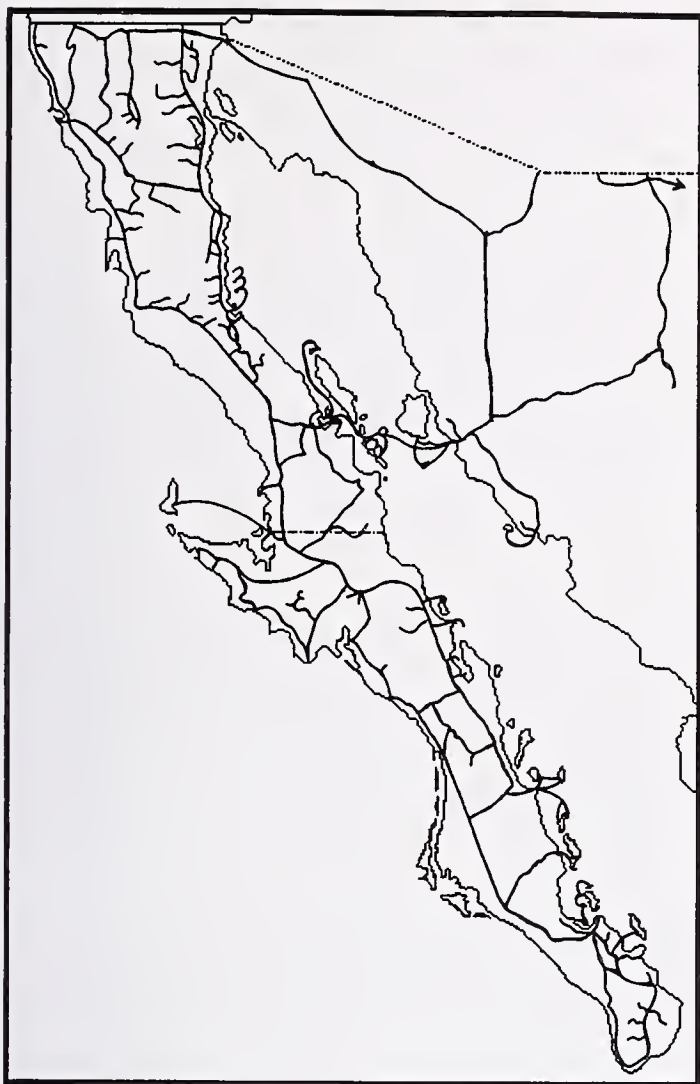


Fig. 7: Routes traveled by GRISMER, 1975–1994, collecting herpetozoans in Baja California. From GRISMER (1994). Reproduced with permission of the author.

6.4. Coahuila

This state has received little attention with few exceptions, as for example in the Cuatro Ciénegas Basin and the southern and northern borders. No over-all summary of work there has appeared. Perhaps the earliest major study was the report by SCHMIDT & OWENS (1944) on the collections of Ernest G. MARSH in 1938–1939 in northern Coahuila. FUGLER & WEBB (1956) reported the collections by a field party from the University of Kansas at two localities in southern and central Coahuila, near Parras and Carolina Canyon, east of San Antonio de las Alazanas. More recently Ernest A. LINER and colleagues have collected in northern Coahuila, particularly in the vicinity of Melchor Múzquiz, Boquillas del Carmen, La Linda, Cuesta de Encantada (these last three on the Sierra del Carmen), and the Serranías del Burro (LINER et al. 1977, 1993). To our knowledge no local group is making any effort to explore the herpetozoans of that state. However, Arturo Contreras ARQUIETA and David LAZCANO of Universidad Autónoma de Nuevo León are making collections in some parts of

Coahuila. The many widely isolated mountain ranges and sand dunes of the state may well harbor more unknown, endemic taxa than any other area of the country.

6.5. Nuevo León

This is probably the best-explored of the northern border states of the country. Many students from the Universidad Autónoma de Nuevo León have explored the entire state. ASEFF-MARTÍNEZ (1967) reported explorations in the central part of the state; VELASCO-TORRES (1970), explorations in the northern part of the state; and TREVIÑO-SALDAÑA (1978) in the southern part of the state. Unfortunately none of these theses have been published, but their specimens and conclusions are available for others. Current studies are rapidly under way for a herpetology of the entire state independently by David LAZCANO of the same university, and by Ernest A. LINER of Houma, Louisiana, both of whom have collected widely within its boundaries. A checklist of the reptiles is available by CONTRERAS ARQUIETA & LAZCANO VILLAREAL (1995), and of amphibians by LAZCANO VILLAREAL & CONTRERAS ARQUIETA (1995).

6.6. Tamaulipas

Although large collections have been made in Tamaulipas, few reports have appeared on them. One of the largest collections is in the Strecker Museum, Baylor University, Waco, Texas (AUTH et al. 2000), and several expeditions from the University of Michigan have resulted in extensive collections at that university. Texas A & M University also has large collections from there. However, no summary of the state herpetofauna has appeared, and although scattered notes have appeared on some material, the only area thoroughly covered is the southern region about Gómez Farias (MARTIN 1958). The Sierra de Tamaulipas has also attracted some attention (MARTIN et al. 1954; SITES & DIXON 1981). Local studies are under way by Pablo LAVÍN of the Instituto Tecnológico de Ciudad Victoria. David LAZCANO of the Universidad Autónoma de Nuevo León is also collecting widely in the state, and David Jiménez RAMOS of the Benemérita Universidad Autónoma de Puebla, in conjunction with the Museo de Zoología of UNAM, is exploring the northern coastal portion. As usual, the most promising area for new distributional information is in the mountainous western region.

6.7. Sinaloa

This state is among the best known states of Mexico, due to the excellent survey of previous work, and field work of their own, by HARDY & MCDIARMID (1969). They dealt with samples from 97 localities scattered over the entire state. Major additions were recorded by MCDIARMID et al. (1976). The earliest major contribu-

tion was that of TAYLOR (1938b), summarizing previous work and adding his own, chiefly coastal, explorations. Despite this thorough coverage, collections from the highest altitudes remain sparse because of difficulty of access, and are in need of extensive augmentation. We are aware of no local groups active in the study of the state herpetofauna.

6.8. Durango

The herpetological exploration in Durango has been largely limited to the plains in the eastern half of the state, where three major highways provide ready access, and to the sole western major highway, from Ciudad Durango toward Mazatlán, Sinaloa, that crosses the Sierra Madre Occidental anywhere between Nayarit and near the U. S. border. The mountains north and south of the Durango-Mazatlán highway are largely terra incognita because of extreme difficulty of access. WEBB (1984) provided an excellent summary of the herpetofauna of the Durango-Mazatlán transect, and has in preparation a summary of present knowledge of the herpetofauna of the entire state. The Instituto de Ecología A.C., with headquarters in Ciudad Durango, is conducting a great deal of ecological work on herpetozoans in the northeastern part of the state, mainly by Hector GADSEN, Rolando GONZÁLEZ and Jorge MUÑÍZ (this last one from CIDIR Durango). The herpetofauna of the important Biosphere Reserve of La Michilía in the northeastern corner of the state was summarized by ALVAREZ & POLACO (1984).

6.9. Zacatecas

This state has attracted little attention, situated as it is more or less in the center of the Mexican plateau, and largely isolated from the invitingly speciose eastern and western sierras. Scattered records exist, but the only thorough report is for the Sierra Morones in the extreme southern part of the state (WILSON & MCCRANIE 1979). We are aware of no current local herpetological activity. Prospects for future study abound throughout the state.

6.10. Aguascalientes

The herpetofauna of Aguascalientes was almost unknown until 1962, when BANTA published the results of his work in the state in 1957, including the collections of David RENTZ in 1960 for the California Academy of Sciences. ANDERSON & LIDICKER (1963) followed with an account of their collections in at least eight localities in the state in 1958–1959, all for the Museum of Vertebrate Zoology at the University of California. WILSON & MCCRANIE (1979) reported their collection from the Sierra Fría in western Aguascalientes. Finally, VÁZQUEZ-DÍAZ & QUINTERO-DÍAZ (1997) published a complete guide to the herpetofauna of the state, based on previous publications and their own extensive explorations over most of a decade.

MCCRANIE & WILSON (2001) also published an account of the herpetofauna of the state, including a brief history of exploration. Thus in less than 40 years knowledge of the herpetofauna of Aguascalientes jumped from a nearly total void to one of the best known in the country.

6.11. San Luis Potosí

By far the most important contributions to the knowledge of the herpetofauna of San Luis Potosí are those of TAYLOR (1949, 1950, 1952, 1953), based primarily on the collections of various crews from Louisiana State University from 1946 to 1952. The localities sampled were scattered pretty much over the entire state (see map in TAYLOR 1950 or 1952). Previous work was also summarized in the first account. Chapman GRANT collected around Ciudad San Luis Potosí in 1958, and that material was reported by GRANT & SMITH (1959). Julio A. LEMOS ESPINAL has collected in the state in recent years, but nothing has yet been published on that material. Aurelio RAMÍREZ-BAUTISTA and associates are completing a survey of the amphibians and reptiles of the Guadalcázar region. We are not aware of any other activity at present.

6.12. Guanajuato

This was one of the earliest states to receive national herpetological attention, by the pioneer Alfredo DUGÈS, and material was sent from there far and wide, as well as being accumulated at the university in Ciudad Guanajuato. The state remains poorly known. At the time that DUGÈS lived, the importance of precise localities and of large series representing geographic variation was not appreciated, hence most material from that era is simply labeled "Guanajuato", and series of one or two was the rule. Thus detailed knowledge of the distribution of the amphibians and reptiles of that state is largely lacking. The best locality list is that of DUGÈS (1896). Marcos ARELLANO was long custodian of the amphibians and reptiles of the DUGÈS Museum, but we are not aware that he has attempted to augment the collection significantly.

6.13. Hidalgo

Long one of the least explored states of the country, early knowledge was confined largely to the area around Pachuca. Completion of the Pan-American Highway through the state in 1932 opened the door to collecting along its length, with numerous brief reports resulting. The first detailed studies came with MARTÍN DEL CAMPO (1936a, 1937a), who reported his work in the region of Actopán and the valley of Mezquital. Explorations initiated in the 1970s in the different regions of the state have been reported by CAMARILLO (1993), and CAMARILLO & CASAS (1998, 2001). A general study of the herpetofauna of the entire state has been under

way since the mid-1980s by Fernando MENDOZA QUIJANO, Irene GOYENECHEA and Oscar FLORES-VILLELA.

6.14. Querétaro

Until DIXON et al. (1972) reported on the collections obtained by Chesley A. KETCHERSID in 1968–1970, Querétaro was herpetologically one of the least known states of the country. Those collections were made primarily along highway 120 in the eastern part of the state. In recent years, Adrián Nieto MONTES DE OCA of the Museo de Zoología, UNAM, has been conducting an intensive survey of the entire state, visiting over 200 localities. The results are in preparation.

6.15. Veracruz

Herpetological exploration has a longer history in Veracruz than in any other state of México, for some five centuries, primarily because Veracruz was long essentially the only door to the country. Much of that history was reviewed by PELCASTRE VILLAFUERTE & FLORES-VILLELA (1992). Significant collections were not made until the early Nineteenth Century, but they accumulated rapidly, initially mostly to the benefit of European museums and herpetologists, but in the latter half of the century also to U. S. institutions. Throughout much of the Twentieth Century the latter were the chief beneficiaries. National involvement began with DUGÈS, who acquired small numbers of specimens from Veracruz, but the first major push was instigated by the creation in 1877 of a Geographical and Exploring Commission of the Republic of México (FERRARI-PEREZ 1886). It amassed a sizeable collection of herpetozoans prior to 1885, and shipped it all to New Orleans for the 1885 World's Fair. The ship burned and sank at Havana, and the entire collection was lost. A hasty replacement was amassed between October 1884 and January 1885, from Puebla and Veracruz, and was successfully shipped to New Orleans. That collection was briefly reported by COPE (1885) and FERRARI-PEREZ (1886), and with a few exceptions is now at the U. S. National Museum.

Recently many Mexican herpetologists have made collections in the state, especially in the region of Los Tuxtlas, an isolated volcanic eminence in southern Veracruz. The most active collectors include Gonzalo PÉREZ HIGAREDA, Aurelio RAMÍREZ-BAUTISTA, Richard VOGT and Oscar FLORES-VILLELA, all from UNAM. Numerous publications by Mexican herpetologists have appeared on the herpetofauna of Los Tuxtlas (see PELCASTRE VILLAFUERTE & FLORES-VILLELA, 1992, for a review). The UNAM field station at Los Tuxtlas has been a major center for exploration of the area, and will probably remain a leading institution of the state. Two other herpetological groups are centered

in Xalapa. One is located at the Universidad Veracruzana, with the participation of Salvador GUZMÁN GUZMÁN and Jorge MORALES MAVIL. The other is the Instituto de Ecología A.C., with Gustavo AGUIRRE LEÓN and Alberto GONZÁLEZ ROMERO. Both groups are exploring widely in the state; results are in preparation.

6.16. Nayarit

The western, coastal region of Nayarit has been relatively well sampled, but the mountainous eastern region of the state is poorly known except for the vicinity of the Tepic-Guadalajara highway. Until about 50 years ago, very little was known from the state. LEWIS & JOHNSON (1955) reported the first sizeable collection, and shortly thereafter other collections were recorded (ZWEIFEL 1959b). MCDIARMID (1963) added important records for the highlands of the eastern part of the state, and ZWEIFEL (1960) and MCDIARMID et al. (1976) reviewed knowledge of the herpetofauna of the Tres Marias Islands. Scattered records continue to appear, but no major studies. We are aware of no local study group, but collectors from the Instituto de Ecología A.C. of Xalapa and Durango have been at work along the Río Grande de Santiago in the central and southern part of the state.

6.17. Jalisco

Due to the long-established importance of Guadalajara as a commercial center, some knowledge of the herpetofauna of Jalisco has been available for almost as long as for any state in the country. Unfortunately the first major collection, supposedly from Guadalajara, made by J. J. MAJOR and sent to the U. S. National Museum, could only in part have been taken there; most must have been taken in more coastal regions, perhaps in Colima (ZWEIFEL 1959a). DUGÈS apparently traveled to Guadalajara occasionally, and obtained some specimens from that vicinity. His collections there are best noted in his summary of the herpetofauna of Mexico (DUGÈS 1896). By that time the general nature of the herpetofauna of the state was apparent, but large gaps remained. TANNER & ROBISON (1960), GRANT & SMITH (1960), and MCDIARMID (1963) reported small regional collections from the western part of the state, but the most intensive survey in the state, on the coast in the vicinity of Chamela, was initiated by CASAS ANDREU (1982) and carried on by RAMÍREZ-BAUTISTA (1994) and by GARCÍA & CEBALLOS (1994). In 1988 RODRÍGUEZ-TORRES & VÁZQUEZ-DÍAZ (1996), from the Instituto de Biología, UNAM, explored the herpetofauna of the municipality of Villa Hidalgo, northern Jalisco. Studies on the western part of the state are currently under way by Paulino PONCE CAMPOS and Sara M. HUERTA, Universidad Autónoma de Guadalajara. Members of the Universidad de Guadalajara, associated with the Biosphere

Reserve of Manantlán, have made herpetological explorations at the field station of Las Joyas (Alicia PÉREZ NUÑEZ and Oscar FLORES-VILLELA), the results of which are in preparation. Despite all these efforts, a number of parts of the state remain poorly known, especially in mountainous areas to the north and toward the Sierra de Colima, and to the east generally on the plateau.

6.18. Colima

Despite its small size, the state of Colima has long been visited sporadically by herpetologists; as early as 1864 new species were described from there, and a total of eighteen species currently recognized have their type localities there, by original designation. All of the early descriptions were of material from "Colima", probably taken near the city by that name. The first intensive study was reported by OLIVER (1937), based on material from both the coastal plain and the plateau. DUELLMAN (1958) reported further collections from widespread localities. During the summer of 1975, C. W. PAINTER explored several regions of the state, and presented his results and a history of herpetological exploration in the state as a Master's dissertation, still unpublished (PAINTER 1976). No local explorations are under way in the state at present, except for that of some personnel of the Universidad de Guadalajara, working in the Biosphere Reserve of Manantlán at Cerro Grande (Alicia LOEZA and Oscar FLORES-VILLELA) and El Tepeixtle. Little work has been done on the Volcán and Nevado de Colima (which lie largely in Jalisco, however), hence the enigmatic report of *Batrachoseps* from there (GADOW 1905) remains unconfirmed.

The Revillagigedo islands, assigned to the state of Colima, have a small herpetofauna, reviewed by BRATTSTROM (1955).

6.19. Michoacán

Although of relatively large size, Michoacán is one of the best-known states of México, primarily because of the explorations of W. E. DUELLMAN, 1951–1960. His analyses of all available information (DUELLMAN 1961, 1965b) blanketed the entire state (DUELLMAN 1961: 130–131, fig. 11). A thorough historical account (DUELLMAN 1961: 7–9) of herpetological exploration of the state up to 1961 noted that the earliest collections were made by Louis John XANTUS in 1863 and by DUGÈS in the late 1800s. An extensive account of expeditions to and history of the isolated Sierra de Coalcomán, southwestern Michoacán, appeared in BRAND & "OTHERS" (1960). The herpetofauna of the area was summarized by PETERS (1954). The area has since become recognized for its considerable endemism. In more recent times, ALVAREZ & DÍAZ-PARDO (1983) explored several localities in the southern coastal part of the state. In ad-

dition, the personnel of the Universidad Michoacana de San Nicolás de Hidalgo (UMSNH) in Morelia has been active on the Pacific coast of the state. GUZMÁN-VILLA (1993) explored the coast during 1988 from the Balsas to the Coahuayana rivers, up to about the 300m asl. J. ALVARADO-DÍAZ and D. HUACUZ-ELIAS are the most active leaders of the UMSNH group. They explored among other areas the Marine Turtle Reserve of Colola and Maruata (ALVARADO-DÍAZ & ZAMORA 1992; ALVARADO-DÍAZ & HUACUZ-ELIAS 1996). Also, students at the Museo de Zoología, UNAM, have collected at the Marine Turtle Reserve of Mexiquillo, southeastern Michoacán; the results of that research are in preparation (VARGAS-SANTA MARÍA 1998).

6.20. Guerrero

The long-term existence of the port of Acapulco assured an early sampling of the herpetofauna of the state of Guerrero, and the major highway from Mexico City to that port facilitated relatively early sampling of that transect. Most of the exploration of the state has radiated from that highway; some areas of the coast have also been sampled. The formidable topography of the state has limited explorations elsewhere; the western and extreme eastern parts of the state remain poorly known. Omiltemi was an important early collecting site in the central Sierra Madre del Sur, as it was on the old Mexico City-Acapulco trail, and in 1985–1986 a group of scientists from the Museo de Zoología, UNAM, made extensive collections in that area (reviewed by FLORES-VILLELA & MUÑOZ-ALONSO 1993). The first knowledge of the mountains farther west was obtained by the extensive pioneer work of ADLER and his group in 1964 and 1969 (reviewed most recently in ADLER 1996). The amphibians and reptiles of the Chilpancingo area, on the modern Mexico City-Acapulco highway, were reviewed in a series of articles by DAVIS & DIXON (1959, 1961, 1965). The only review of the herpetofauna of the entire state is a bachelor's dissertation by SALDAÑA DE LA RIVA & PÉREZ-RAMOS (1987), and a checklist which briefly reviewed earlier exploration in the state (PÉREZ-RAMOS et al. 2000). The mountains of northern Guerrero and the adjacent state of México were explored by personnel from the Museo de Zoología, UNAM, in 1986–1987 (FLORES-VILLELA & HERNÁNDEZ-GARCÍA 1989). A group from the Laboratorio de Vertebrados from the Facultad de Ciencias, UNAM, has made surveys for many years of the vertebrates in the vicinity of Laguna de Tres Palos, near Acapulco, with results in preparation. Another group currently active in making ecological studies of various species is led by Biól. Elizabeth BELTRÁN SÁNCHEZ of the Instituto de Investigaciones Científicas of the Universidad Autónoma de Guerrero, Chilpancingo.

6.21. Morelos

This state has been relatively well explored, thanks to its proximity to Mexico City, small size and position on the transect Mexico City-Acapulco. One of the earliest reports was on the herpetofauna of the Lagunas de Zempoala (MARTÍN DEL CAMPO 1940). Students working with W. B. DAVIS of Texas A & M University in 1949 and 1950 explored the state rather extensively, in collaboration with personnel from the Division of Wildlife in Mexico City, as reported by DAVIS & SMITH (1953a, 1953b, 1953c). CASTRO-FRANCO & BUSTOS-ZAGAL (1994) reported in part on extensive explorations with ARANDA-ESCOBAR during 1980 and 1981 – research that was based on an earlier dissertation (CASTRO-FRANCO & ARANDA-ESCOBAR, 1984). BUSTOS-SAGAL and CASTRO-FRANCO still lead explorations of the state by their students from the Universidad Autónoma del Estado de Morelos.

6.22. Estado de México

The state of México, despite its proximity to Mexico City, has not been systematically explored, although even as early as the early 1800's material was described from there that DEPPE collected. Only sporadic, incidental collections were made until recently. Between 1981 and 1985 José Luis CAMARILLO of FES-Izta-cala, UNAM, explored mostly southwestern parts of the state (CAMARILLO & SMITH 1992). The San Cayetano area, municipality of Villa de Allende, was explored in 1982 (MARTÍNEZ-CORONEL & VELÁZQUEZ 1984). VEGA-LÓPEZ & ALVAREZ (1992) of the Instituto Politécnico Nacional (IPN) explored extensively the eastern mountains, and also explored between 1988 and 1990 the Sierra Nevada that contains the Ixtaccihuatl and Popocatepetl volcanos – an area that lies on the borders of the states of México, Puebla and Morelos. More recently, CASAS-ANDREU et al. (1997) explored widely in the state. MANJARREZ & AGUILAR-MIGUEL (1995) collected intensively in 1991 and 1992 in the Nahuatlaca-Matlazínca Park southeast of Toluca; they remain among the most active workers in the state.

6.23. Distrito Federal

The valley of México has received herpetological attention from earliest times, prehistorically as well as historically, from the Aztecs through Francisco HERNÁNDEZ to the present. DUGÈS (1888) provided the earliest summary for the Valley of Mexico, which embraces much of the Distrito Federal, and HERRERA followed shortly thereafter with several articles on the vertebrates in general, the latest in 1893. SÁNCHEZ-HERRERA (1980b) reported on the explorations in the late 1970s by students at the Facultad de Ciencias, UNAM, in the Pedregal de San Ángel. GONZÁLEZ et al. (1986) assessed the status of the amphibians and reptiles of the

Valley of Mexico, and CASAS-ANDREU (1989) summarized herpetological exploration there. MÉNDEZ DE LA CRUZ et al. (1992) reported their explorations of 1979–1981 in the Sierra de Guadalupe within the limits of the Distrito Federal and the state of México. In 1999, URIBE-PENÁ et al. published an account of the herpetofauna of the mountains surrounding the Valley of México, based only in collections housed at the Instituto de Biología, UNAM. Although this attempt is valuable it is still incomplete since other collections were not included, leaving several important records unreported.

6.24. Puebla

This is a poorly explored state in general, although some areas, e.g., near Tehuacán, are rather well known through numerous scattered collections acquired in transit along major travel routes. WEBB & FUGLER (1957) reported on collections made in several areas of the state by students from the University of Kansas. Systematic collecting has been in progress from 1993 to the present by Luis CANSECO MÁRQUEZ and Guadalupe GUTIÉRREZ MAYÉN of the Museo de Zoología, UNAM, and the Benemérita Universidad Autónoma de Puebla, centering upon Zapotitlán Salinas, the Valley of Tehuacán-Cuicatlán, and the Sierra Norte de Puebla. Their results are in preparation.

6.25. Tlaxcala

Being of small size and off any major travel route, this state has received little attention in the past. Systematic exploration by Oscar SÁNCHEZ HERRERA and Gerardo LÓPEZ ORTEGA was undertaken in 1976–1977, covering much of the state, and was summarized, together with a review of previous work, by SÁNCHEZ-HERRERA (1980a). The University of Tlaxcala started a exploration research in conjunction with U. S. Fish & Wildlife Service in 2002. The leading herpetologist is Jesús FERNÁNDEZ FERNÁNDEZ; he and his team have covered 70% of the state, collecting in numerous localities and doubling the number of taxa reported by SÁNCHEZ HERRERA (1980a).

6.26. Oaxaca

This is the most topographically, climatically and biotically diverse state of Mexico, with both Atlantic and Pacific drainage, and for that reason has the most diverse herpetofauna of any state. Many collections have been made by various workers, so that some parts are very well known, whereas others, more rugged, are poorly known. Thomas MACDOUGALL (1896–1973) did more than any other person to sample remote parts of the state accessible only on foot. He thus discovered dozens of new species, some of which have never been rediscovered. His collections over a period of ~30 years total some 10,000–15,000 specimens, most now in AMNH, UIMNH and UCM. He collected much like the

explorers of earliest times, with one or two native Indians, walking in wilderness mountains for days, often in trailless areas. He reported in a popular account some of his travels in eastern Oaxaca (MACDOUGALL 1971). CASAS-ANDREU (1996) reviewed briefly the history of exploration in the state. Nevertheless, the northeastern and southwestern highlands are the least known, whereas the plateau surrounding Oaxaca City, the plains and mountains surrounding Tehuantepec, and the Isthmus of Tehuantepec generally, are the best explored. Summaries for the Isthmus of Tehuantepec have appeared by HARTWEG & OLIVER (1940) and DUELLMAN (1960). No systematic coverage of the state as a whole has been undertaken, but CASAS-ANDREU et al. (1996) published a list of species known for the state, based on published records, museum records and their own field work. CANSECO-MÁRQUEZ (1996) described the collection he made in 1993–1994 for the Museo de Zoología, UNAM, in the region of Cerro Piedra Larga and the Cañada de Cuicatlán. RENDÓN-ROJAS et al. (1998) explored a small portion of the Atlantic versant in the municipality of San Juan La Lana at Santiago Jalahuí, documenting the loss of diversity in the herpetofauna of the rain forest there. A. RENDÓN and M. MANCILLA continue exploring from their headquarters at the Instituto Tecnológico Agropecuario in Tuxtepec, Oaxaca.

6.27. Chiapas

Chiapas is one of the few states that have been explored extensively by Mexican nationals, less by foreign collectors. The principal explorer of the state was Miguel ALVAREZ DEL TORO, who began his explorations in the 1940s. His autobiography (1985) reviews his exploration, and the third edition of his book on the reptiles of the state appeared in 1982. Eizi MATUDA, an accomplished botanist who owned a coffee finca, La Esperanza, was a generous host of numerous visiting scientists in the 1930s and 1940s, including several herpetologists who made large collections in that area. JOHNSON (1989, 1990) explored widely in the state in the course of a biogeographical study of northwestern Nuclear Central America, which includes most of the states of Chiapas, Tabasco, eastern Oaxaca and southern Veracruz. More recently, personnel from the Instituto de Historia Natural de Chiapas in Tuxtla Gutiérrez (Roberto LUNA) and the Colegio de la Frontera Sur in San Cristóbal de Las Casas (Antonio MUÑOZ, Marco LAZCANO) have been surveying throughout the state. Their groups have explored mainly in the State Reserve System at El Triunfo (ESPINOZA-M. et al. 1999a), Montes Azules (LAZCANO-BARRERO et al. 1993), and El Ocote (MUÑOZ-ALONSO et al. 1996; MARTÍNEZ-CASTELLANOS & MUÑOZ-ALONSO 1998; ESPINOZA-M. et al. 1999b). LEE's (1996) book on the herpetology of the Yucatán península incorporates at least

11 localities in the northern part of the state. Extreme northeastern Chiapas is included in the area covered by CAMPBELL (1998) in his review of the herpetology of northern Guatemala, although no localities are indicated.

6.28. Tabasco

Tabasco is one of the many states that have received little attention, even in the present century. W. A. WEBER collected some herpetozoans in conjunction with archaeological studies at La Venta (SMITH 1944), and V. E. THATCHER collected some material near Teapa (SMITH 1960). J. D. JOHNSON included the state in his studies (1989, 1990), but most other collections have been incidental. LEE's (1996) book on the herpetology of the Yucatán península includes at least 7 localities in Tabasco that are considered as part of the península. Rosario BARRAGÁN VÁZQUEZ leads an active group at the Universidad Juárez Autónoma de Tabasco in Villahermosa. CAMPBELL (1998) included extreme eastern Tabasco in the area covered in his review of the herpetology of northern Guatemala, although no localities are indicated.

6.29. Campeche

The hinterlands of Campeche remain poorly known. LEE (1996) reviewed the history of exploration in the state, including his own extensive work, and cited 52 localities from which material was known. Among the earlier works are those of GAIGE (1938), SMITH (1938), DUELLMAN (1965a) and DUNDEE et al. (1986). The only local group of which we are aware, continuing explorations in the state, is led by Carmen POZO, with the participation of Rogelio CEDEÑO and René ROMEL of the Colegio de la Frontera Sur (ECOSUR), Chetumal, Quintana Roo, jointly with Carlos GALINDO from Stanford University. They have been exploring the Calakmul Biosphere Reserve since 1998, probably the last major stand of rain forest left in the country that has had very little human influence. Results of this exploration are in preparation. CAMPBELL (1998) includes part of Campeche in the area covered in his review of the herpetology of northern Guatemala, although no localities are given.

6.30. Yucatán

This is better known herpetologically than any other state of the peninsula, due for the most part to the important commercial center of Mérida, and its proximity to famed archeological sites such as Chichén Itzá and Cobá. The earliest collections were made mostly by Europeans and a few North Americans. In the Twentieth Century, the earliest explorations were incidental to archeological studies. E. H. THOMPSON's work from 1885 to 1909 garnered a few herpetozoans, reported by BARBOUR & COLE (1906) and by FOWLER (1913). Later

archeological exploration sponsored by the Carnegie Institute of Washington at the Oxkutzcab and other sites resulted in collection of a few more amphibians and reptiles, reported by GAIGE (1936, 1938) and PEARSE (1945). The Carnegie Institute exploration of the Mayapán archeological site was also productive of herpetological materials that were deposited in the Field Museum. These and other collection were reported by SCHMIDT & ANDREWS (1936). ANDREWS (1937) himself collected at Chichén Itzá and Cobá and reported on the snakes. SMITH (1938) reported on a collection he made during the summer of 1936 in Yucatán and Campeche. MASLIN (1963a, b) reported on the collections of his group in 1959, and DUELLMAN's group explored the peninsula in 1962, following which he presented the first review of the herpetology of the peninsula (DUELLMAN 1965a). DUNDEE et al. (1986) reported the results of work in northern Yucatán in 1992 and 1993. LEE began his epochal explorations in 1974, and his work though 1977 was summarized in his first account of the herpetofauna of the peninsula of Yucatán (LEE 1980). He continued his work in following years, culminated with his 1996 book, which is the current definitive treatment of the herpetology of the entire Yucatán Peninsula.

6.31. Quintana Roo

Until recently, Quintana Roo was virtually a terra incognita herpetologically. Probably the first significant account of its herpetofauna was that of PETERS (1953), based on specimens collected in the forties by M. CÁRDENAS-FIGUEROA of the IPN. More recently, LÓPEZ-GONZÁLEZ (1991) explored the eastern part of the state. LEE (1996) reviewed previous work and summarized the herpetofauna as known from 40 collecting sites scattered over most of the state. BAHENA-BASAVE (1994) summarized his extensive work in especially the southern part of the state. He and C. POZO, R. CEDEÑO and R. ROMEL continue their explorations of the state from their base in ECOSUR in Chetumal.

7. PERSPECTIVES

In Mexico, as elsewhere, isolation of biotic populations on elevations or in depressions has led over time to high endemism. The extreme topographic and climatic diversity of Mexico, in conjunction with its very active geological history (FLORES-VILLELA & GERETZ 1994), has been exceptionally conducive to endemism, the herpetological limits of which remain extensively unknown, although 685 species (59%) of the 1156 of amphibians and reptiles known from Mexico (known species as of July 2003) are endemic (FLORES-VILLELA & CANSECO-MÁRQUEZ in press). The herpetofaunal diversity of Mexico, covering 1,958,201 km², exceeds that of any other political area in the world of ap-

proximately comparable size (SMITH & SMITH 1976: 9–14).

Thus the limits of herpetological diversity in Mexico remain a significant challenge for the future. The accompanying graph (Fig. 8), extrapolated using a logarithmic model from the data in FLORES-VILLELA & CANSECO-MÁRQUEZ (in press), suggests a likely trend over the next few decades. We are aware of other taxa that are in press or have been discovered but are not yet described. We know of many such species of salamanders, as well as several *Eleutherodactylus*, a few lizards and probably a few snakes. Many of these taxa come from remote places but some of them do not; they pertain to groups that have been poorly studied or that have a problematic taxonomic history.

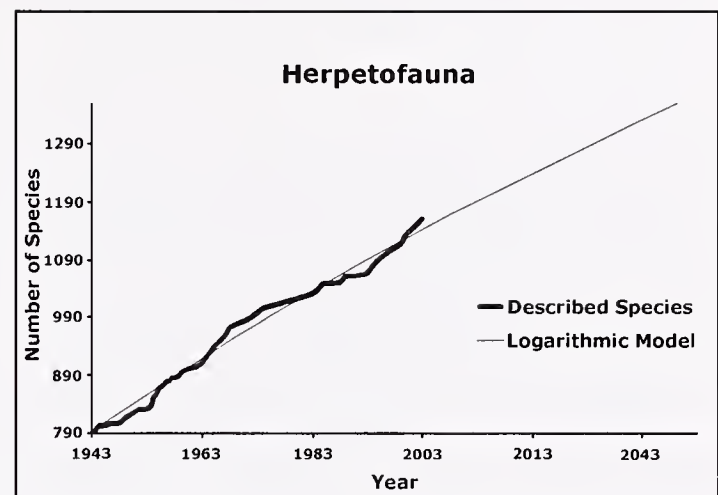


Fig. 8: A graphic projection of the number of amphibian and reptile species that may be expected to occur in Mexico in 2050, providing trends of the past few decades are maintained. Based on data in FLORES-VILLELA and CANSECO-MÁRQUEZ (in press).

In terms of exploration, there are extensive areas of the country that have not been adequately collected; this is particularly true for Oaxaca, Chiapas, Campeche, Guerrero, Michoacán, Sinaloa, and Durango.

As challenging as diversity itself is the distribution of all taxa; the geographic ranges of even common species are not yet adequately known. The development of broadly representative, authoritatively identified comparative collections, as well as literature resources, in various centers of Mexico is vital to future advancements. With the recent flourish of the Mexican herpetological community (FLORES-VILLELA 1987) it is expected that Mexican institutions will take a more important role in the exploration of the country. Nevertheless these institutions need more infrastructure (collections and libraries), as well as professional herpetologists, to accomplish such a task. Likewise, the sister disciplines of ecology, ethology and physiology must continue to develop herpetological interfaces so as to

encourage the maturation of Mexican herpetology along multidisciplinary lines. Unfortunately much important herpetological information lies buried and largely inaccessible in unpublished dissertations, some of which are mentioned here.

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